

COMPOSITE METAL PIPE COUPLING AND ASSEMBLY

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Background of the Invention

1. Field of the Invention

The present invention relates to techniques and components for joining pipes, in particular, metal pipes.

2. Description of the Related Art

As used here, the word "coupling" and the phrase "pipe coupling" refer to components for joining relatively short pipes or tubes, especially metal pipes or tubes, typically for the purpose of forming an extended length of pipe. The requirements for such pipe couplings include a tight, preferably leak-proof seal between the adjoining pipe ends and corrosion protection for the bare metal of the pipe ends.

Summary of the Invention

In one aspect, the present invention is embodied in components for joining pipe ends.

1 The present invention also is embodied in a coupling for joining pipe ends and in the
2 resulting pipe joint and joined pipe sections.

3 In another aspect, the present invention is embodied in a pipe assembly, comprising
4 first and second metal pipes having respective first and second ends; a first plastic
5 cuff molded along the periphery of the first pipe end and a mating second plastic
6 cuff molded along the periphery of the second pipe end. In a specific embodiment,
7 the cuffs form a tongue and groove joint.

8 In yet another aspect, the present invention is embodied in a pipe assembly,
9 comprising: first and second metal pipes having longitudinal axes and respective
10 first and second ends; a first plastic cuff formed along the periphery of the first
11 pipe end and a second plastic cuff formed along the periphery of the second pipe
12 end, the first and second cuffs having a tongue and a groove, respectively, with the
13 first, tongue cuff inserted into the second, groove cuff; first and second wire hoops
14 mounted over the first and second pipe ends; and a plurality of bolt fasteners for
15 tightening the first and second hoops and the first and second pipe ends axially, to
16 seat the first and second pipe ends against the first and second cuffs, seat the first
17 and second cuffs against one another, and seal the pipe ends against the cuffs.

18 In still another aspect, the present invention is embodied in a pipe assembly,
19 comprising: first and second metal pipes having respective first and second ends;
20 first and second plastic cuffs formed over the first and second pipe ends,
21 respectively, with each cuff forming a shoulder; first and second wire hoops
22 mounted around the first and second pipe ends, respectively; and a plurality of
23 fasteners extending between the hoops and clamping the hoops against the
24 shoulders and the first and second pipe ends against the first and second cuffs.

25 In a further aspect, the present invention is embodied in components suitable for
26 forming a composite metal and plastic pipe assembly, comprising: first and second

1 metal pipes having longitudinal axes and respective first and second ends; a first
2 plastic cuff formed around the periphery of the first pipe end and a second plastic
3 cuff formed around the periphery of the second pipe end, with the first and second
4 cuffs having a tongue and a groove, respectively, adapted for mating when the first
5 cuff is inserted into the second cuff. The components further include first and
6 second wire hoops of size and configuration adapted for mounting over and
7 engaging the first and second pipe ends, respectively; and a plurality of fasteners
8 adapted for clamping the first and second hoops and the first and second pipe ends
9 axially.

10 In a further, method aspect, the present invention is embodied in a method for
11 fastening and sealing first and second pipes at respective first and second ends
12 thereof, comprising: molding first and second mating, plastic cuffs around the
13 periphery of the respective first and second pipe ends, with each cuff having a
14 shoulder; assembling a first hoop and a second hoop around the first pipe end and
15 the second pipe end adjacent the shoulders thereof; and clamping the first and
16 second hoops together generally axially along the first and second pipes, thereby
17 clamping the hoops against the shoulders and the first and second pipe ends
18 against the first and second cuffs.

19 **Brief Description of the Drawings**

20 The present invention is described with respect to the following drawings.

21 Figure 1 is a perspective view of a pipe assembly in accordance with an
22 embodiment of the present invention.

1 Figure 2 is an exploded view of components of the pipe assembly of Figure 1,
2 including two pipes or pipe sections, prior to joinder using the coupling of Figure 1,
3 and wire hoops and plastic cuffs that are components of the coupling.

4 Figure 3 depicts components of the coupling of Figures 1 and 2, in particular the
5 wire hoops and bolts of the coupling.

6 Figure 4 depicts an end of one of the pipe sections of Figure 1 that is cut away to
7 effect a cross-section view showing the shape of the cuff and the mounting of the
8 cuff on the pipe end.

9 Figure 5 depicts a cross section through the lips of the cuffs that are mounted on
10 the pipe ends, and schematically shows the mating of the cuffs as the pipe
11 assembly of Figure 1 (also Figure 2) is being formed.

12 Figure 6 is a perspective view, in the manner of Figure 1, of a pipe assembly in
13 accordance with another embodiment of the present invention, one using bolted
14 wire rings or hoops.

15 Figure 7 depicts components of the coupling of Figure 6, in particular, the wire
16 hoops and bolts of the coupling.

17 Figure 8 is a cross section representation of yet another embodiment of the present
18 invention, a pipe assembly incorporating a bell and spigot coupling.

19 Detailed Description

20 Figure 1 depicts a pipe assembly 10 comprising sections spiral corrugated pipes or
21 pipe sections 11 and 12 which are joined by coupling 13, and Figure 2 depicts the

1 pipe sections of Figure 1 prior to assembly. The illustrated pipe section 11
2 comprises spiral corrugations 14 and has a cuff 15 formed on end 16 thereof. The
3 pipe section 12 comprises corrugations 14 and has cuff 18 formed on end 19
4 thereof. The invention is also applicable to smooth wall pipe.

5 The mating cuffs 15 and 18 have tongue and groove configurations, respectively.
6 See Figure 5. Preferably, cuffs 15 and 18 are formed of plastic material such as
7 polyethylene. The cuffs 15, 18 are molded in place with formed tongue and groove.
8 The pipe ends 16, 19 are embedded in the molded plastic cuffs.

9 The couplings 13 include wire hoop assemblies 31 and 32 (also called wire wraps),
10 which are depicted separately in Figure 3 and are shown mounted on the mating
11 pipe sections 11 and 12, respectively, in Figures 1 and 2. In the depicted
12 embodiment, the couplings 13 comprise cuffs 15 and 18 and hoop assemblies 31
13 and 32, although components of different size and/or shape can be used. As
14 shown, hoop assemblies 31 and 32 can be identical or similar.

15 The illustrated hoop assemblies 31 and 32 comprise generally circular wire hoops
16 33 having one or more (typically a plurality of) bolt-receiving peripheral loops 35-35
17 formed integrally with or joined to the associated hoop and lying generally in the
18 plane of the associated hoop for receiving fasteners such as bolts 34. The
19 illustrated bolts 34 are oriented approximately parallel to the longitudinal axis of the
20 pipe and are used to tighten or clamp the pipe sections axially, illustratively
21 generally parallel to the longitudinal axis, for clamping and compressing the cuffs
22 and securely joining the pipe sections 11 and 12 to one another via the cuffs. See
23 Figures 1 and 6.

24 The hoop assemblies 31 and 32 depicted in Figure 3 are welded, that is, the hoops
25 33 are formed with a gap and the ends of the hoop at the gap are joined together
26 by a weld 38, typically after the hoops are mounted on the pipe ends 16 and 19.

1 However, the hoops 33 can be mounted on the pipe ends either before or after the
2 cuffs 15 and 18 are applied, but are conveniently mounted on the pipe ends in the
3 shop before the cuffs are applied and the ends are assembled. See Figure 2.

4 As shown in Figure 2, the cuffs 15 and 18 can be formed with shoulders or lips 39
5 against which the hoops 33 are seated. The shoulders permit the use of hoops of a
6 size such that the hoops fit snugly on the pipes but are sufficiently loose to permit
7 rotation for alignment with one another.

8 Figures 6 and 7 depict an alternative set of wire hoop assemblies 31, 32. Each of
9 the hoops 33 illustrated in Figure 7 has a gap therein and a bolt loop 37 formed or
10 attached at each end of the hoop adjacent the gap. The loops 37 extend transverse
11 to the plane of the associated hoop in the illustrated embodiment, preferably along
12 planes approximately radial to the associated hoop so that a bolt 36 can be inserted
13 through the loops for tightening the hoop against the pipe periphery to securely
14 mount the hoop on the pipe. The bolts 36 can be loosened to permit rotation of
15 one or both hoops around the pipe to align the hoops and the loops 35 thereof for
16 insertion and tightening of the bolts 34. See Figure 6.

17 In one suitable sequence for joining the pipe sections 11 and 12, prior to or after
18 forming the cuffs, the hoop assemblies 31 and 32 are positioned on the ends 16
19 and 19 of the respective pipe sections 11 and 12 and are secured by means such
20 as the welded joints 38, Figures 1 and 3, or the bolts 36, Figures 6 and 7. The
21 cuffs 15 and 18 are formed on the pipe ends 16 and 19 of the pipe sections 11
22 and 12. The alignment of the hoops 33 is adjusted as necessary (by simply rotating
23 the welded version, or in the case of the bolted version, by loosening the nuts
24 mounted on the ends of bolts 36 as required to permit rotation of one or both
25 hoops, and then tightening the bolts as required) to align the loops 35 of hoop
26 assembly 31 with the loops 35 of hoop assembly 32. Bolts 34-34 are inserted
27 through the aligned pairs of loops 35-35 and nuts are threaded onto the ends of

1 each bolt and threaded further onto the bolt to tighten the pipe ends 16 and 19
2 against the cuffs 15 and 18. This tightening of the bolts 34 securely joins the pipe
3 sections together and compresses the cuffs 15 and 18 together and against the
4 pipe ends to provide a positive, leak-proof, corrosion-resistant joint.

5 The couplings 13 are readily mounted on the pipe sections, readily aligned, and
6 readily removed, and the alignment is readily adjusted. The process of coupling is
7 accomplished using bolts, nuts and either welded wire rings/hoops or bolted wire
8 rings/hoops, or equivalent simple hardware. In addition, despite the simple,
9 inexpensive, easy-to-use structure and construction, the couplings provide secure,
10 leak-proof joinder of the pipe sections.

11 In an alternative to loops which are formed integral with the wire hoops 33, the
12 loops 35 and/or 37 can be separate members which are bolted or welded to the
13 hoops.

14 As described, for spiral corrugated metal pipe, the present invention is embodied in
15 wire wraps using means such as welds or bolts to hold the wires on the pipe ends
16 and bolts to pull and hold the two pipe ends together to form a positive joint with
17 the cuffs.

18 As alluded to above, the present invention is also applicable to other types of pipes,
19 including smooth wall pipes and the wire wraps can be placed on the pipes prior to
20 placing other materials such as cuffs on the pipe ends.

21 As indicated above, the sealing gaskets or cuffs according to the present invention
22 are molded onto smooth or corrugated pipe ends, and embed the bare, cut-off pipe
23 ends in a protective cocoon of plastic which provides corrosion protection. Molded
24 plastic can be formed by rotating the associated pipe end and laying on extruded
25 plastic bead around the circumference of the pipe end. Then the excess material

1 built up on the end can be folded over into the interior of the pipe. After set up,
2 the resulting plastic "globbs" are machined to provide neater looking end(s). Care is
3 taken not to place too much material into the interior diameter of the pipe, because
4 excess material can impede and restrict flow within the pipe.

5 Preferably, to form the cuffs used here, inside and outside mold dies are used.
6 Molten or semi-molten plastic is extruded to fill the void between the inside and
7 outside dies, then under pressure the dies clamp and push the semi-molten
8 extruded material into the cavities in the mold dies to create the tongue and groove
9 profile or other selected profiles. The use of inside/outside dies under pressure
10 moves the necessary plastic material to the outside of the pipe and a reduced
11 amount of material to the inside diameter of the pipe sufficient to embed the pipe
12 end and provide the necessary corrosion protection.

13
14 In one of the pipe forming techniques used by the assignee, three layer
15 polyethylene is coated onto a metal strip, top and bottom, before the strip is
16 formed into smooth wall or corrugated pipe. Such a plastic coated pipe is
17 compatible with plastic welding and plastic welding to a variety of profiles and with
18 a variety of cuffs and other plastic components of couplings.

19 One such profile is used in pipe 40, Figure 8. This figure depicts a bell and spigot
20 coupling 43 which joins corrugated pipe sections 41 and 42. The coupling 43
21 comprises a plastic cuff formed by spigot section 45 and bell section 48. The cuffs
22 optionally and preferably include metal cores 51 and 52. The spigot and bell cuff
23 sections 45 and 48 are formed on the corrugated pipe ends 41 and 42 as described
24 above. The spigot section 45 and the bell section 48 are joined to their respective
25 pipe ends by joints 53 and 54. Conveniently, when plastic coated pipes are used,
26 as described above, these joints are plastic welds. Other types of joints can be
27 used, such as bolts or rivets, but plastic welds are preferred. Also, wire hoops
28 such as or similar to 31 and 32 can be used to augment the couplings 43 and can

1 be used in conjunction with cuffs having shoulders similar to the shoulders 39,
2 Figure 2. The couplings 43 are applicable to a variety of pipes and pipe sizes.

3 Having thus described pipe couplings, pipe assemblies using the couplings and
4 methods for forming and installing the couplings, all in accordance with the present
5 invention, those of usual skill in the art will adapt the invention to other
6 embodiments and derive other embodiments, limited solely by the claims appended
7 hereto.